scale). Each bulletin is invariably begun with the letters U.S.W.B. Each station has its code letter, as for instance, NY designates New York. The first three figures express the barometric pressure in inches reduced to sea level; the fourth figure is wind direction (1 = N., 2 = NE., 3 = E., etc.); the fifth and last figure is wind force in the Beaufort scale, except when winds of greater force than 9 occur when words instead of figures will be used.

Base charts (size 11½ by 14 inches) of the Atlantic coast extending to the 55th meridian, will be supplied free to vessel masters who regularly take and forward weather observations to the United States Weather Bureau, or to the Hydrographic Office, United States Navy; others may obtain them at a cost of 75 cents a hundred.

A similar service for the Pacific coast is in preparation and will be announced later.

The advantages to be derived from such a service are manifold. While it is primarily intended for coast use, shipping and the like, it would seem that the fruit grower, the cotton grower, and in fact any large business whose following days' work is largely dependent upon the weather would find this service invaluable. Wireless apparatus has been developed to such a state that for less than $10 a simple outfit may be obtained, which is sufficient to receive from the larger stations, if they are not too far away. At the greatest distance from a sending station in this country a $25 outfit would suffice. The writer has an outfit consisting of an aerial, detector, coil, and phones (cost $10) with which he is able to obtain not only Arlington, but many other stations. Arlington sends out comparatively slowly so that it is but a matter of a few weeks practice before one is able to receive well.—*I. F. H.*

LONG INDIVIDUAL METEOROLOGICAL RECORDS.

In a short article on page 413 of the MONTHLY WEATHER REVIEW for July, 1920, reporting the death of a veteran cooperative observer of the Weather Bureau, at the age of 103 years, the author says: "It is believed that this individual record for more than 66 years is unparalleled in this country, if not in the world."

In this connection I beg to call attention to the meteorological record kept by Mr. H. D. Gowey, at North Lewisburg, Ohio, from January, 1832, to June, 1909, a period of 77½ years.

Mr. Gowey began the observations when he was 13 years old, and continued them at practically the same location up to within a few days of his death at over 90 years of age.

The thermometer was read three times a day, and there is scarcely an observation missing during the whole period of time. The temperature observations were begun in 1832, and the rainfall record in 1852. We know of no other individual series of temperature observations of this length in existence.—*J. Warren Smith.*

THE GREAT SUN-SPOT GROUP AND THE MAGNETIC STORM, MARCH 22-23, 1920.

By the Rev. A. L. CORTIE, S. J.

[Abstracted from Monthly Notices Roy. Astr. Soc., 80: 574-578, 1920, April.]

A small spot appearing December 27, 1919, developed into a fine group which had almost died away at the third return February 17–26; revival took place on an immense scale at the next return March 16–29, the group being the greatest since 1917. The months of December, 1919, and January to February, 1920, were magnetically quiet, only a few days being much disturbed. Moderate disturbances accompanied the appearances of the group January 1 and 28, and a more severe storm on February 24; the March revival was accompanied by a magnetic storm of extreme violence March 22–23. All these disturbances appeared at 27-day intervals.

Cortie holds that the greater frequency of magnetic disturbances near the equinoxes is due to the fact that then the heliographic latitude of the earth is in the sun's semiequatorial plane, i. e., in the region of the sun spots; such a position is particularly favorable in the period after the maximum of a sun-spot cycle, when the mean latitude of the sun spots is falling toward the solar equator (*Cf.* M. N., **73:** 58, 1912; **76:** 16, 1915). In the present instance both these conditions were satisfied.

If we suppose that the requisite ionisation of the upper atmosphere is a gradual process as spots begin to grow in number and magnitude, then the advent of a specially active or large spot will suffice to bring about a great storm. In this case there had been a well-marked drop in the values of the monthly ranges of the magnetic elements since October, 1919, indicating that the ionisation of the upper atmosphere due to the successive presentments of the disturbed solar region in December and January was not sufficiently great to cause any but minor disturbances; the conditions were better in February and a moderate storm took place, but the climax was reached in March, when all the conditions—a great disturbed sun-spot region, a favorable heliographic position of the earth, and a highly charged condition of the upper atmosphere—were realized. Anyone of these conditions alone might be sufficient to cause a storm, and hence storms may appear without spots or very small spots; and vice versa, since a large spot need not necessarily be very active. (*Cf.* M. N., **73:** 155, 1913; Astrophys. Jour., **13:** 260, 1901; **49:** 20, 1919). See MONTHLY WEATHER REVIEW, July, 1920, **48:**379.—*E. W. W.*

INTERNAL FRICTION IN THE ATMOSPHERE.

By D. BRUNT.

[Abstracted from *Quar. Jour. Roy. Met'l Soc.*, April, 1920, 46, 175-185. Shorter abstract in *Nature* (London), Feb. 26, 1920, p. 714.]

The frictional force R acting upon unit volume of the atmosphere may be measured by the amount of horizontal momentum lost per unit of time; this internal friction is chiefly due to eddy viscosity, and according to Taylor the components of R along the axes of x and y are $K\rho d^2u/dz^2$ and $K\rho d^2v/dz^2$, respectively, $R = f(z)$. In the steady state, the forces acting on the air at any level, due to gradient, rotation, and internal friction, must be in equilibrium. Assuming (1), K to be constant throughout the height considered, (2) the gradient wind G to be constant or a linear function of the height z, and (3) the direction of slipping at the boundary to be in the direction of strain, these conditions lead to a vector equation whose solution shows that the wind V at any height is equivalent to G plus an added component $\sqrt{2}G \sin \alpha \, e^{-Bz}$ acting at an angle $\alpha + \frac{3\pi}{4} - Bz$ with the direction of G. This component decreases with height according to the exponential law, rotates its direction uniformly counter-clockwise with increasing height, and sweeps out the equiangular spiral previously treated by Hesselberg and Sverdrup, Ekman, and Whipple. The equations are equivalent to those of Taylor derived by a different method.

If F denotes the frictional force per unit *surface* acting at any place, then it may be shown that $R = -dF/dz = K\rho\frac{d^2V}{dz^2}$, and $R = \sqrt{2B}.Fe,^{\frac{i\pi}{4}}$ showing that R always acts at an angle $\pi/4$ with the reversed wind direction, which latter itself makes an angle α with the isobar. Now, the angle between R and V, β, can be evaluated and measured independently of any theory whatsoever; this has been done a number of times, the results having been collected and added to by Åkerblom. Taking the mean values of a great number of observations at different localities, it is found that for observations at the top and base of the Eiffel Tower in Paris, particularly in winter, the value of β is in excellent agreement with theory, but for most of the other stations it is poor; this discrepancy can not be explained away by effects of local topography, departure from a steady state, etc. It can be due only to an error in the assumption that K is constant with height. For β to be 45° it is necessary and sufficient that $V = G(\cos\alpha - \sin\alpha)$, independently, again, of any theory; this holds good for Paris, but not for the other places. This relation was derived from *theory* by Taylor on the *assumption* that K did not vary with height.

A discussion of Åkerblom's computations are given; and there is appended a general solution of the problem in the cases where B varies inversely as z or z^2; the solution, however, seems to be open to criticism.—*E. W. W.*

THE GLACIAL CATASTROPHIES IN THE VALLEY OF CHAMONIX IN THE SEVENTEENTH CENTURY AND THE VARIATIONS OF CLIMATE.

By CHARLES RABOT.

[Abstracted from *La Nature*, Aug. 28, 1920, pp. 129-134.]

At the recent *Congres de l'Alpinisme* held at Monaco, an interesting communication relative to the glacial advances and retreats in the valley of Chamonix was presented by Mr. Paul Mougin, the inspector general of waters and forests, and Mr. Letonnelier, registrar of Isère. A record of the movements of the *Mer de Glace* since the year 1600 reveals that that glacier is now at the stage of greatest retreat, and that in 1644 it probably was at a stage of greatest advance. There are records of the destruction of four villages by the glacier in 1644; there are ruins of two remaining to this day, but the location of the remaining two is not known.

There are several evidences of the successive stages of the *Glacier des Bois:* First. The fact the villages mentioned above were located as they were indicates that the mountaineers must have regarded these locations as secure. Such a belief would be founded upon the experience of their forefathers who had probably not been menaced by advancing ice nor by the torrents from the melting ice. This leads to the presumption that perhaps several centuries previous to 1600 there had existed a period of reduced glaciation.

Second. It is known that the Grindelwald glacier in Switzerland experienced a maximum advance about 1601 which was sufficient to destroy villages.

Third. For 250 years after 1600 the fluctuations were such as might accompany a maximum.

Fourth. Since 1850 the retreat has been so marked as to be as conspicuous as was the advance of 1644.

If, therefore, there was a period of maximum glaciation between 1600 and 1850, it is to be supposed that the climatic conditions over Europe were such as to be especially conducive to the formation of ice in the mountains—in other words, there must have been a period of greater cold or increased humidity. Also, the marked decrease in ice in the last 60 or 70 years points to a higher temperature in Europe, or to a decrease in the amount of precipitation, or to an increase in the insolation. Finally, the activity of the glacier in the last 300 years points quite definitely to a climatic variation.

Within these large-amplitude variations are, of course, many short-period variations of small amplitude. For instance, measures made by the observers of the department of waters and forests show since 1914 a maximum annual advance of 117 meters in the case of the Argentière glacier in 1917–18, the total in five years being about 200 meters. The Bois glacier appears to be either stationery or slightly increasing, whereas those of Tour and Bossons show annual movements of the order of 50 meters.[1]—*C. L. M.*

INVERSIONS OF TEMPERATURE IN THE LOWER LAYERS OF THE ATMOSPHERE IN THE ANTARCTIC.

By J. ROUCH.

[Abstracted from *Comptes Rendus*, (Paris Acad.), Sept. 6, 1920, pp. 498-500.]

During the wintering of the Charcot expedition on Petermann Island in the Antarctic at latitude 65° 10′ S. and longitude 66° 34′ W., Paris, temperature observations were made at an altitude of 2 meters and at 35 meters above the ground. The higher station was located upon a hill, and the two stations were about 300 meters apart. The thermometers were exposed in shelters and observations were made at 10 o'clock each day. The results are based upon 202 observations. The differences of temperature by months were as follows:

March.	April.	May.	June.	July.	August.	September.	October.
−0.01	+0.13	+0.45	+0.34	+0.23	−0.17	−0.33	−0.52

The plus sign (+) indicates an inversion.

There were 45 inversions noted in the 202 observations. The greatest inversion amounted to 5.3° C. on July 1.

The effect of wind, temperature, cloudiness, and barometric pressure were studied. It was found that inversions occur most frequently with calms or weak winds. The highest wind with which an inversion occurred was a northeast wind of 20 km. per hour, upon which occasion the inversion amounted to 0.3° C. The lower the temperature the more marked was the inversion. The greatest inversions occurred with clear sky and decreased with increase of cloudiness. The mean barometric pressure was about 740 mm. In no case was an inversion observed with a barometer below 720 mm. The inversions were increasingly frequent with a higher barometer. The registering thermometers indicated that when the diurnal march of the temperature at the upper shelter was plotted against the difference in temperature between the two shelters, the two resulting curves were exactly inverse, a high temperature at the upper station resulting in a minimum of difference.—*C. L. M.*

[1] In this connection, the recent advance of the Grindelwald glacier in Switzerland is of interest. A note in the *Elmira* (*N. Y.*) *Herald*, Apr. 13, 1920, says:

"A number of visitors and some scientists are witnessing a strange Alpine phenomenon at Grindelwald, where the famous Grindelwald glacier has been moving into the valley at the rate of 4 to 6 feet daily.

"It has already destroyed a pine forest and crushed a stone bridge across the Black Lutschine into atoms. The ice river continues advancing across the water to the upward bank.

"The rapid movement is due to the enormous amount of ice and snow on the higher portions of the glacier. * * *"—EDITOR.